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City of Franklin Solar Study



Evaluating Municipal Sites for Solar Generation

May 2011



HISTORIC
FRANKLIN
TENNESSEE

S U S T A I N A B I L I T Y

Purpose of the Scoping Exercise

Tennessee has become a hub for the manufacturing side of the solar industry. Congruently, TVA initiated an incentive program to encourage the adoption of solar installations throughout the Valley. Increasingly, businesses and homeowners throughout the state are weighing the costs and benefits of solar. The price on panels has decreased significantly in the past few years, the number of certified installers has risen, and the incentives are there to make solar within reach.

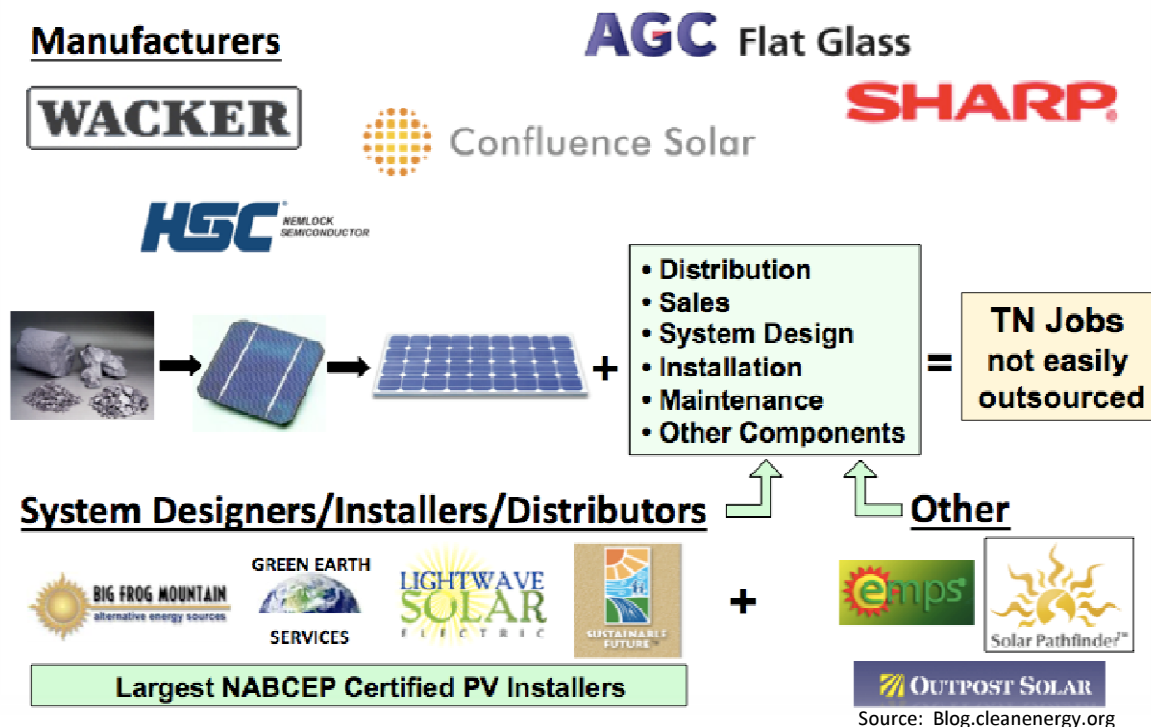
The City of Franklin owns a significant amount of property and is due diligently considering the appropriateness of solar on municipal property and how it could be funded.

In the pages ahead, the City looks at the burgeoning industry in Tennessee, the TVA Generation Partners Program, funding opportunities specifically the third party finance model, specific municipal sites, and successful case studies.



The Emerging Solar Industry in Tennessee

A graphic of the growing Tennessee Solar Supply Chain



Tennessee is developing a successful solar supply chain that spans the length of the state. The industry is providing jobs for Tennesseans, growth for the local economy, and a source of clean, renewable energy. In fact, the two largest industrial investments in Tennessee history are the \$1.5 billion Hemlock Semiconductor manufacturing facility in Clarksville and the \$1.7 billion Nissan invested to mass produce electric vehicles and battery packs.

TVA Generation Partners Program

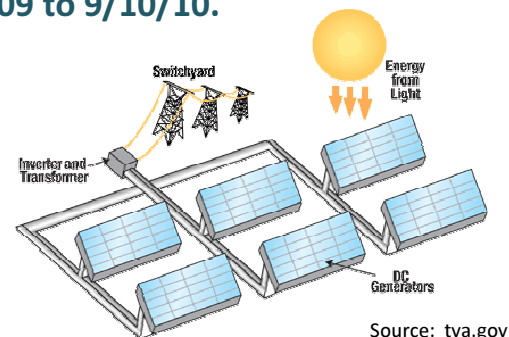
TVA has been a key player in the production of solar energy. The TVA Generation Partners Program allows owners of solar systems to sell the electricity generated from solar power to the electric grid. Participants are rewarded with a \$1,000 check upon signing up and are incentivized by TVA to sell the solar power to the electric grid. TVA will purchase this power for 22 cents/kWh, which is a 12 cent premium. Additionally, businesses and homeowners are eligible to receive a 30% federal tax credit for installing solar. Municipalities, however, are not eligible for the 30% tax credit.

In July of 2010, TVA changed the requirements of the program. Previously any system under 1 megawatt (MW) qualified, but TVA scaled it down and capped the program at 200 kW, which is only 20% of the maximum size under the previous rules. TVA does account for large single arrays in excess of 200 kW through the Renewable Standard Offer, but the incentive has not enticed many third party financial agreements. In September 2011, TVA again decreased the maximum size of solar installations to 50 kW. The end result of the Generation Partners Program has led to an expansion of many small-scale commercial and residential systems.

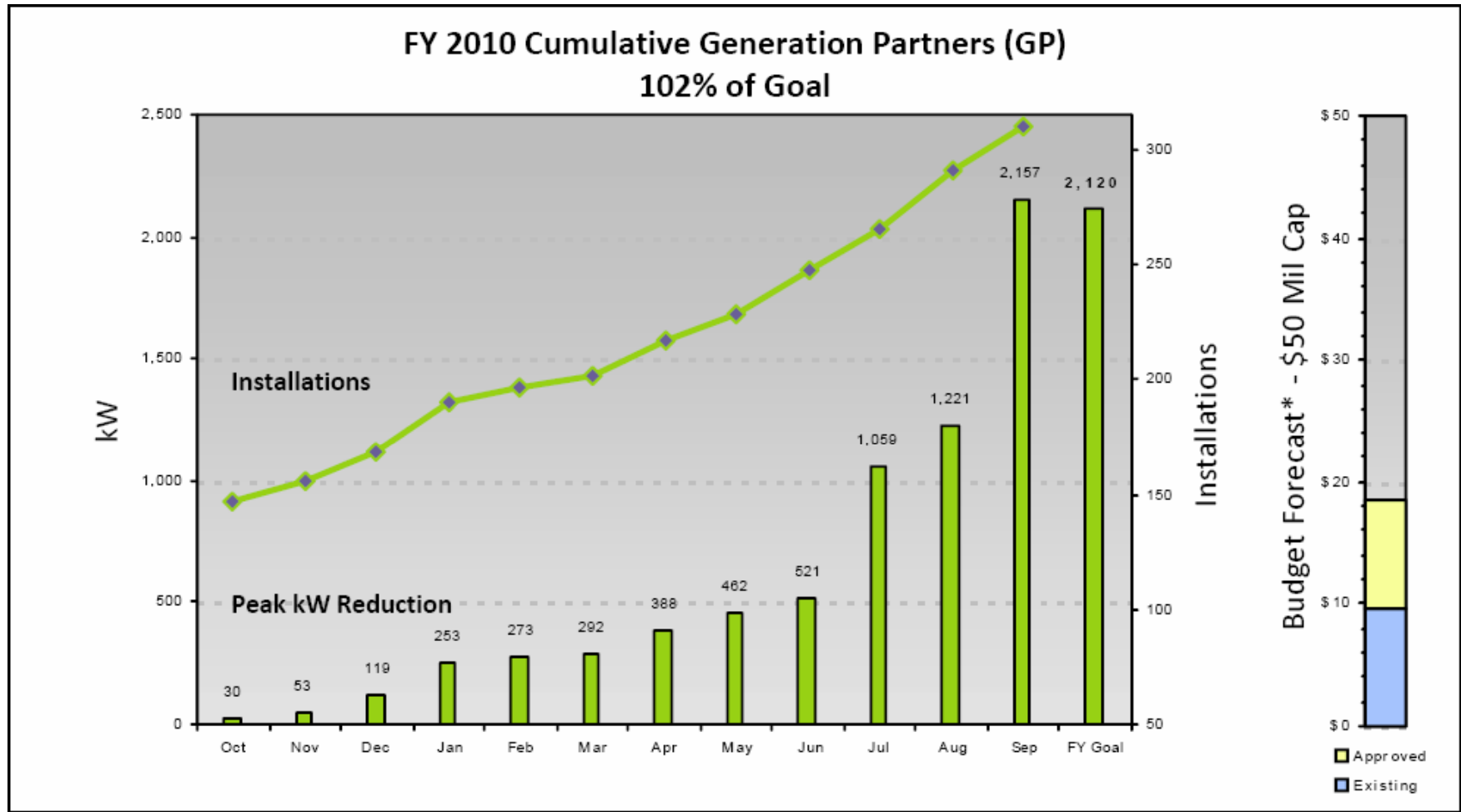
New solar installations less than 1 MW reported from 9/1/09 to 9/10/10.

Rankings with Generation Partners included:

- TVA: 42,656 kW
- New Jersey:31,643 kW
- California:26,163 kW
- Pennsylvania:7,849 kW
- Massachusetts:2,987 kW



TVA Generation Partners Program



* Budget Forecast includes existing and approved (pending installation) systems of 200 kW or less.

From October of 2009 to September of 2010, the number of solar installations in the Generation Partners Program more than doubled. Simultaneously, peak kW reduction went from 30 kW to 2,157 kW. Reducing peak demand helps manage customer consumption at critical times of the day.



Solar Suitability Study for Municipal Property

- How can the City Finance a solar array?
- How do you determine the best sites?
- Where are the best sites?
- Does it make *cents*?

II. Funding Options for City of Franklin

The City of Franklin has an opportunity to generate revenue and clean energy on its underutilized property via one of the three following options, or a combination thereof:

- The City could seek to place a solar installation project on the **CIP list**. This alternative is not ideal for the City because of the inability to capture the 30% federal tax credit and the sheer capital outlay required for a solar project. The City would also have to designate significant staff time or hire consultants to help facilitate the project.
- The City could solicit **grant funding**. This option raises many questions including the amount of staff time required, specific regulatory and reporting requirements, and the unlikelihood that the grant would cover the entire cost of the array, leaving the City or a third party responsible for the remaining balance.
- The City could seek a **3rd party financing model**, whereby the City would lease space to a solar developer who will fund, construct, operate, and maintain the system for a designated number of years. This option is viable because it does not require an upfront monetary investment for the City, but rather the City would receive a payment for leasing property for the development of clean, renewable energy.



How Does the Third Party Financing Model Work?

The third party financing model is an emerging tool for municipalities and utilities because it makes financial sense. Private entities are eligible for all tax credits and incentives. The City would lease space to a solar developer, backed by investors. *The third Party would fund, construct, operate, and maintain the solar system.* All of the energy generated would be purchased by TVA and transmitted into the electric grid. TVA would pay the City of Franklin for all power generated. The City would then serve as a pass through between TVA and the third party owner of the solar photovoltaic system, but would also earn a specified amount of revenue for the lease of the land.

There are several benefits to the City and the greater community for this type of arrangement. Mainly, the City would be putting unused land into production and establish a new revenue stream. The community would be made more aware of clean and renewable energy technologies and these projects may even spark property owners to consider solar for their own buildings.

- *Third Party would be eligible for all tax credits & incentives*
- *City would issue an RFQ or RFI to determine solar developer*
- *City would serve as pass through between TVA & Third Party*
- *Third Party would compensate City for use of land*
- *Minimal outlay of city funds/minimal responsibility*
- *Catapult underutilized property into production*
- *Innovative Leadership Opportunity;*

This model has worked for many municipalities across the country. They are commonly referred to as Power Purchase Agreements (PPA) and typically occur in states that require their electricity providers to produce a certain amount of renewable energy. TVA allows PPAs, but the growth of this type of arrangement has been severely held back by the 200 kW maximum size limitation of the Generation Partners Program.



Evaluating Municipal Sites for 3rd Party Agreements

What are the key criteria to be considered?

What properties does the City own?

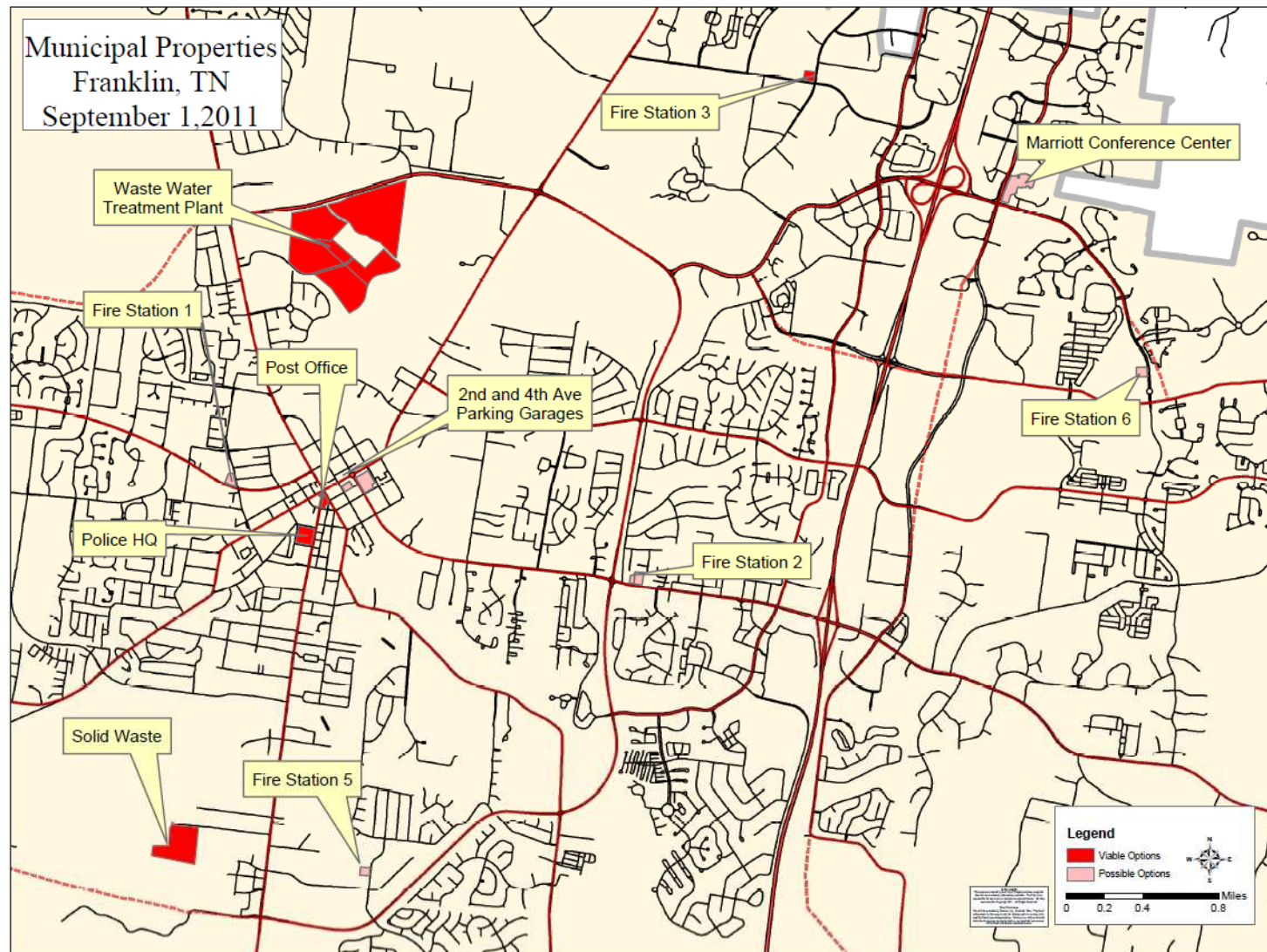
Which sites are appropriate?

Key Criteria for Evaluating Municipal Sites

- **Maximum of 200 kW system** (1/2 to 1 acre of land) for Generation Partners program;
- Adequate space for **large systems** in order to attract 3rd party;
- Ability to **connect to grid**;
- Making certain an acceptable level of **security** is available;
- Consideration of **future plans** for the proposed property;
- Compliance with **historic district design guidelines**;

The financial case must be made in order for the City to fund, construct, operate, and maintain its own solar arrays. **Currently, the return on investment is not there for the City to self-fund solar projects.**

However, the third party finance model makes it possible for the City to participate, earn a revenue stream, and advance renewable energy technology with minimal staff time and financial resources. This arrangement allows the City to put unused land resources into production.



The City of Franklin owns a significant amount of property and has an opportunity to generate revenue and produce clean and renewable energy from its land resources. The red parcels indicate City ownership. In order for a parcel to be deemed suitable for solar, several factors must be considered including: solar availability, lot size, roof size, ability to connect to the grid, zoning requirements, historic district design guidelines, security, safety, the size of the installation, future plans for the property, and the return on investment. Given these criteria, the table on the following page evaluates properties best suited for a solar array.

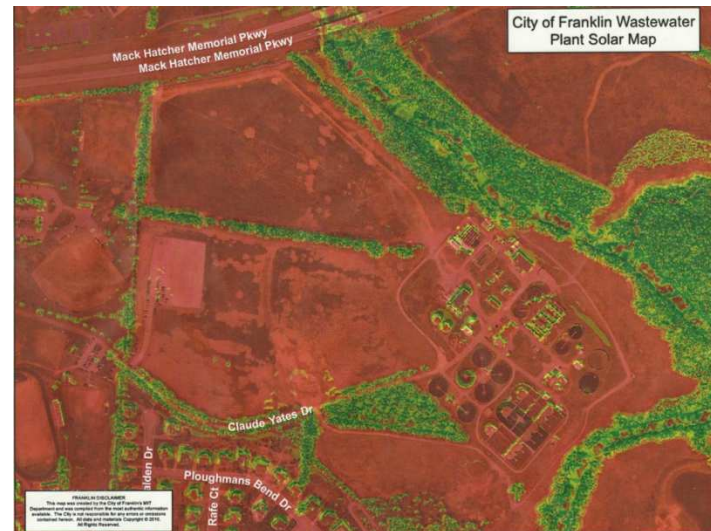
Evaluation of Municipal Sites for 3 rd Party Solar Finance Model									
Municipal Site	Address	Solar Potential	Roof or Ground Mounted?	Conform to Zoning & Historic District Design Guidelines	Size (kW)	Security Issues?	Economic Impact	Grid Connectivity?	Viable Option?
Waste Water Treatment Plan	136 Claude Yates	High	Ground	Yes	200 kW	No	High	Yes	Yes
	135 Claude Yates	High	Ground	Yes					
Police HQ	900 Columbia Ave	High	Parking Garage	Yes	NA	No	High	Yes	Yes
Post Office	510 Columbia Ave	High	Roof	Yes	50-100 kW	No	Medium	Yes	Yes
Fire 3	370 Mallory Station Road	High	Ground	Yes	40-50 kW	No	Medium	Yes	Yes
Solid Waste	417 Century Court	High	Ground	Yes	150-200 kW	No	High	Likely	Yes
Parking Garages	2nd Ave S & 4th Ave S	High	Mounted Roof	No	60-80 kW each	Maybe	Medium	Yes	Possibly
Marriot Conference Center	700 Cool Springs Blvd	High	Roof	Yes	100 kW	No	Medium	Yes	Possibly
Fire 1	500 New Hwy 96W	Fair	Roof	Yes	20 kW	No	Low	Yes	Unlikely
Fire 2	907 Murfreesboro Rd	Fair	Roof	Yes	20 kW	No	Low	Yes	Unlikely
Fire 5	215 Noah Dr	High	Roof	Yes	15-20 kW	No	Low	Yes	Unlikely
Fire 6	1061 Cool Springs Blvd	Fair	Roof	Yes	20 kW	No	Low	Yes	Unlikely
Water Reservoir	850/846 Lewisburg Pike	High	reservoir	Yes	Small	No	low	Yes	No
Parks Facilities	Harlinsdale, Eastern Flank	High	Ground	No	NA	Yes	NA	No	No
City Hall	109 3rd Ave S	High	Roof	Yes	100-200 kW	No	Significant	Yes	No
Fire 4	2093 Fieldstone Pkwy	Fair	Roof	Yes	10 kW	No	Low	Yes	No

The City of Franklin owns a significant amount of property and has an opportunity to put some of its land resources to work by generating revenue and clean energy. The results from this table indicate that the Wastewater Treatment Plant, the Five Points Post Office, the police parking garage, solid waste facility, and Fire Station 3 are optimal sites for a PPA.

Placing Solar on Municipal Sites

Placing solar on municipal sites requires careful consideration of many factors to ensure a mutually beneficial agreement. The following sites have been deemed favorable for a power purchase agreement:

- The City's **Wastewater Treatment Plant** is a favorable site. The 110 acre parcel is home to a former sludge field and has limited uses. Solar serves as a very low-impact and potentially profitable opportunity for unused portions of the site. Yet, considerations for solar should be veiled by expansion plans of existing operations. The site gets much direct sun and could accommodate an array much larger than 200 kW.



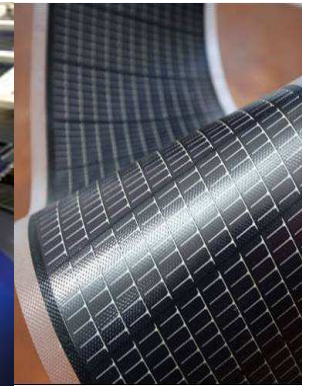
Placing Solar on Municipal Sites

- The **Police Department Parking Garage** directly behind the headquarters could accommodate a large solar canopy. With almost an acre of parking, a mounted system would provide shade for vehicles and clean energy. By virtue of its location, the system would be well protected and secure. The City estimates a 200 kW system could be established.
- The **Post Office Rooftop** could accommodate a medium-sized array, about 50 kW, without detracting from the historic structure due to the building's parapet roofline. The building is south facing, the roof is secure, and this would further solidify the City's commitment to preservation and sustainability.
- Fire Station 3** on Mallory Station could support a ground mounted system behind the building in the neighborhood of 50kW. Fire stations are secure and this particular site receives a lot of sun.
- Both downtown **Parking Garages on 2nd and 4th Ave** are good candidates but would need to pass historic zoning; it is estimated they could accommodate 100-200 kW systems. The top floors of the garage are not flat and the panels would need to be attached to an elevated canopy. This would provide shade for vehicles and likely escalate the cost.



Placing Solar on Municipal Sites

- The **Solid Waste facility** on Century Court contains suitable space for a solar array, particularly on the empty lot facing the street. This space has good southerly sun exposure, would be secure given its proximity to the County jail, and could accommodate a large scale system in the 150-200 kW range. However, there are other options for utilizing this space.
- The City owns the **Marriott Conference Center** and roof space and solar availability exist for an array, but the legal work could be prohibitive. If legitimate option, this site would require a more thorough examination.
- City Hall** would be a good candidate, but its future is uncertain. It would also require review by the Historic Zoning Commission, just as the Post Office and parking garages would.
- Over 700 acres of **Franklin Parks** exist. Many are historic parks and the incorporation of solar would not be compatible with the purpose and use of the facilities. Most of the acreage falls in the flood plain and moreover, the electrical infrastructure would need to be improved in order to tie into a solar array, which could be costly.
- The City should also consider solar availability for **future projects and acquisitions**.
- Other City locations not listed might be good for small scale systems, but are not suitable for a power purchase agreement.



The background of the slide is a high-resolution, close-up photograph of a solar panel array. The panels are arranged in a grid, with each panel having a hexagonal or octagonal shape. The color of the panels is a deep blue, and the lines between them are a lighter blue. The perspective is from a slightly elevated angle, looking down at the array.

Case Studies for 3rd Party Agreements

City of Knoxville, TN

90 kW on Convention Center Roof

City of Raleigh, NC

1.2 MW @ Waste Water Facility (10 acres)

500 kW on convention center roof

250kW on rooftop of WWTP building

Knoxville Convention Center

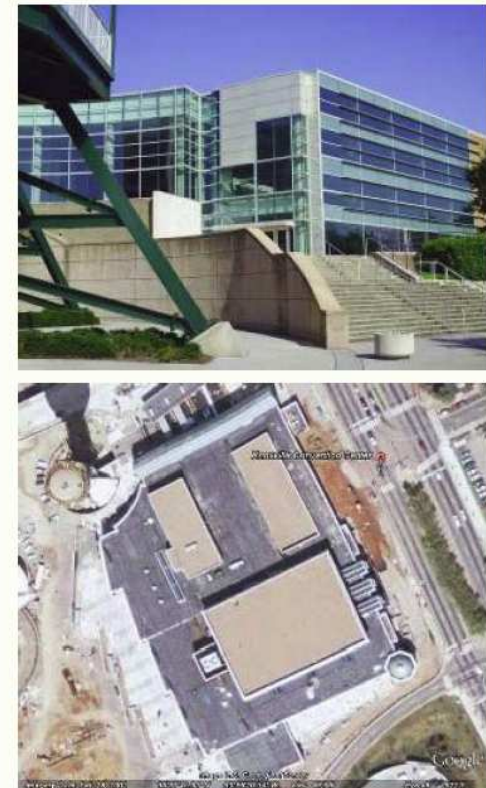
90kW roof mounted system; complimented energy efficiency upgrades

- Received \$250,000 DOE solar grant that was used to help fund the project;
- Issued RFP for 3rd Party Finance—selected FLS Energy
- FLS Energy contributed \$150,000
- City receives Income of \$10,000 annually from FLS Energy; 7 years = \$70,000
- Option to own outright in year 7 at depreciated cost (est. \$45,000)
- Upon City ownership, expected annual income of \$27,400 (yrs. 8-10 = \$ 82,200)
- Offsets energy equivalent of 8 homes.

Note: After year ten, \$15,000 annual electricity offset + GPP incentives of up to \$14,000 annually. Payback in 15-19 years, depending on TVA incentives.

Saves up to \$685,000 over 40 years

Knoxville staff hope this type of financing agreement can serve as a model for other municipalities across the TVA region. It was also indicated that reconciling the legal issues took approximately one year.



Raleigh, NC

In 2008, the City of Raleigh Public Utilities Department began investigating solar generation and identified the wastewater treatment plant site as a potential location for an array. This was done with the assistance of Innovative Design, an internationally known and environmentally sensitive architectural firm based in Raleigh.

The City decided to go the route of power purchase agreements (PPA) and invited several experienced solar power developers to provide a project bid in response to Progress Energy Carolinas' request for renewable energy proposals, issued initially in November 2007. **The company's request is designed to meet the requirements of North Carolina's Renewable Energy and Efficiency Portfolio Standard**, passed in 2007. The legislation requires that utilities such as Progress get at least 3 percent of their retail sales from renewable energy sources by 2012 and requires the power companies to tap solar energy. After an extensive evaluation process, Progress Energy Carolinas accepted Southern Energy's proposal.



The City of Raleigh only owns one solar array, a small 30 kW facility at the city's Brentwood Operations Center, which has yet to be commissioned. However, Raleigh signed power-purchase agreements (PPA) for a 250 kW PV system installed at the E.M. Johnson Water Treatment Plant, which is now being expanded to 400 kW. It also signed a PPA for power produced by the 1.3 megawatt Neuse River Solar Farm at the Neuse River Wastewater Treatment Plant. The new Raleigh Convention Center will also have a 500 kW system covering 60% of the roof, making this the City's fourth solar PV system.

Raleigh, NC

The **250 kW** solar photovoltaic array at the E.M. Johnson Water Treatment Plant produces an estimated 325,000 kilowatt-hours of electricity per year, roughly equivalent to the annual energy use of about 25 homes in North Carolina. Durham-based Carolina Solar Energy is leasing the 117,000- square-foot clearwell building rooftop from the City for the solar photovoltaic array and it is currently being expanded to 400 kW. The renewable energy that is produced from the project is sold to Progress Energy Carolinas under its SunSense Commercial PV Program. The state of North Carolina passed the Renewable Energy and Energy Efficiency Portfolio Standard (REPS) law. This requires utility providers like Duke Energy and Progress Energy to produce a certain amount of renewable energy and a certain amount of solar power.



The partnership between the City of Raleigh, Progress Energy, Southern Energy and NxGen Power is propelling underused city lands to produce clean energy and jobs for North Carolina.

In July of 2009, the Raleigh City Council approved the largest of the arrays, an agreement that will allow a **1.2 MW** solar photovoltaic array to be built at the Neuse River Wastewater Treatment Plant. The Neuse River Solar Farm is a joint project of City of Raleigh, Progress Energy Carolinas, Southern Energy Management and NxGen Power. The solar array will generate approximately 1.7 million kilowatt-hours of electricity per year, roughly equivalent to the annual energy use of about 130 homes in North Carolina. The project will reduce carbon dioxide emissions by more than 1,300 metric tons annually. Like the solar photovoltaic array project at the E.M. Johnson Water Treatment Plant, no City capital investment will be required for the Neuse River Solar Farm. **The City of Raleigh will earn \$680,000 in revenue over the life of the 20 year lease, with no capital investment required.**

City of Raleigh WWTP 1.2 MW Rent Exhibit

EXHIBIT B												
YEAR	LEASE PERIOD	LEASE RATE/AC *	ANNUAL RENT **	P L U S	CURRENT YEAR'S INTEREST (3.5%) ***	P L U S	TOTAL PRIOR YEARS' DEFERRED RENT	P L U S	INTEREST ON PRIOR YEARS' DEFERRED RENT AT 3.5% ***	E Q U A L S	CUMULATIVE DEFERRED RENT TOTAL	
1	10/1/10 - 9/30/11	\$ 1,850.00	\$ 17,883.96	+	\$ 625.94	+		+		=	\$ 18,509.89	
2	10/1/11 - 9/30/12	\$ 1,905.50	\$ 18,420.47	+	\$ 644.72	+	\$ 18,509.89	+	\$ 647.85	=	\$ 38,222.92	
3	10/1/12 - 9/30/13	\$ 1,962.67	\$ 18,973.08	+	\$ 664.06	+	\$ 38,222.92	+	\$ 1,337.80	=	\$ 59,197.86	
4	10/1/13 - 9/30/14	\$ 2,021.54	\$ 19,542.28	+	\$ 683.98	+	\$ 59,197.86	+	\$ 2,071.93	=	\$ 81,496.04	
5	10/1/14 - 9/30/15	\$ 2,082.19	\$ 20,128.54	+	\$ 704.50	+	\$ 81,496.04	+	\$ 2,852.36	=	\$ 105,181.45	
6	10/1/15 - 9/30/16	\$ 2,144.66	\$ 20,732.40	+	\$ 725.63	+	\$ 105,181.45	+	\$ 3,681.35	=	\$ 130,320.83	
7	10/1/16 - 9/30/17	\$ 2,209.00	\$ 21,354.37	+	\$ 747.40	+	\$ 130,320.83	+	\$ 4,561.23	=	\$ 156,983.83	
8	10/1/17 - 9/30/18	\$ 2,275.27	\$ 21,995.00	+	\$ 769.83	+	\$ 156,983.83	+	\$ 5,494.43	=	\$ 185,243.10	
9	10/1/18 - 9/30/19	\$ 2,343.52	\$ 22,654.95	+	\$ 792.92	+	\$ 185,243.10	+	\$ 6,483.51	=	\$ 215,174.38	
10	10/1/19 - 9/30/20	\$ 2,413.83	\$ 23,334.50	+	\$ 816.71	+	\$ 215,174.38	+	\$ 7,531.10	=	\$ 246,856.69	
11	10/1/20 - 9/30/21	\$ 2,486.25	\$ 24,034.53	+	\$ 841.21	+	\$ 246,856.69	+	\$ 8,639.98	=	\$ 280,372.41	
12	10/1/21 - 9/30/22	\$ 2,560.83	\$ 24,755.57	+	\$ 866.44	+	\$ 280,372.41	+	\$ 9,813.03	=	\$ 315,807.46	
13	10/1/22 - 9/30/23	\$ 2,637.66	\$ 25,498.24	+	\$ 892.44	+	\$ 315,807.46	+	\$ 11,053.26	=	\$ 353,251.40	
14	10/1/23 - 9/30/24	\$ 2,716.79	\$ 26,263.18	+	\$ 919.21	+	\$ 353,251.40	+	\$ 12,363.80	=	\$ 392,797.59	
15	10/1/24 - 9/30/25	\$ 2,798.29	\$ 27,051.08	+	\$ 946.79	+	\$ 392,797.59	+	\$ 13,747.92	=	\$ 434,543.37	
16	10/1/25 - 9/30/26	\$ 2,882.24	\$ 27,862.61	+	\$ 975.19	+	\$ 434,543.37	+	\$ 15,209.02	=	\$ 478,590.19	
17	10/1/26 - 9/30/27	\$ 2,968.71	\$ 28,698.49	+	\$ 1,004.45	+	\$ 478,590.19	+	\$ 16,750.66	=	\$ 525,043.79	
18	10/1/27 - 9/30/28	\$ 3,057.77	\$ 29,559.44	+	\$ 1,034.58	+	\$ 525,043.79	+	\$ 18,376.53	=	\$ 574,014.34	
19	10/1/28 - 9/30/29	\$ 3,149.50	\$ 30,446.23	+	\$ 1,065.62	+	\$ 574,014.34	+	\$ 20,090.50	=	\$ 625,616.69	
20	10/1/29 - 9/30/30	\$ 3,243.99	\$ 31,359.61	+	\$ 1,097.59	+	\$ 625,616.69	+	\$ 21,896.58	=	\$ 679,970.48	
* Lease Rate/Ac reflects 3% annual escalators.												
** Annual Rent is based on 9.667 acre lease area.												
*** 3.5% Interest Charged on Deferred Rents												
City Receives \$680,000 over 20 years with no capital outlay												

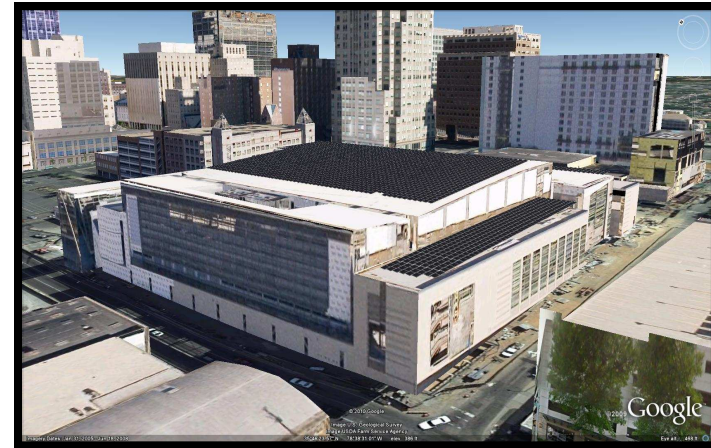
Raleigh, NC

The Raleigh Convention Center will be among the first in the nation to have solar on its roof. This \$2.5-3 million investment will produce 500 kW of power, approximately enough to power 100 homes. Similar to their other power purchase agreements, the City signed a 20 year lease of the property to the energy developer. The energy developer negotiated and entered into a contract with Progress Energy to buy the generated power for terms of lease. The energy developer is responsible for analysis, design, installation, and operates array at no cost to the City.

After tax credit and depreciation, the City has the option to purchase the array at 7-10 years of the lease at a discount with the same terms of purchase of power by Progress Energy.



Proposed layout for solar Convention Center



Conclusion

This report is the beginning of a long-term strategy to consider solar arrays for existing and future municipal property. The environmental and social benefits are self evident, but the economic return is only advantageous when part of a 3rd party power purchase agreement since municipalities cannot capture all of the available incentives. The work of Raleigh should serve as a model for Franklin, but it should also be noted North Carolina has a renewable energy standard that requires its utilities to generate solar power.

The TVA Generation Partners Program offers a generous incentive up to 200 kW, but only offers a marginal financial incentive for any single array over 200 kW. This limits the size of a potential array to 200 kW which is typically too small a system to attract a power purchase agreement. The City could potentially lease several sites to get the volume necessary for a third party agreement, yet the 110 acre Franklin Wastewater Treatment Plant site serves as an ideal location to harvest solar power on a large scale.